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Joint ICTP-IAEA School of Nuclear Energy Management

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Knowledge Management and Safety Performance in NPPs

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International Atomic Energy Agency

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20-November
5th Nuclear Energy Management School
2012 Trieste Italy

J. de Grosbois, Section Head
Nuclear Knowledge Management
Department of Nuclear Energy

History shows us knowledge can be lost!

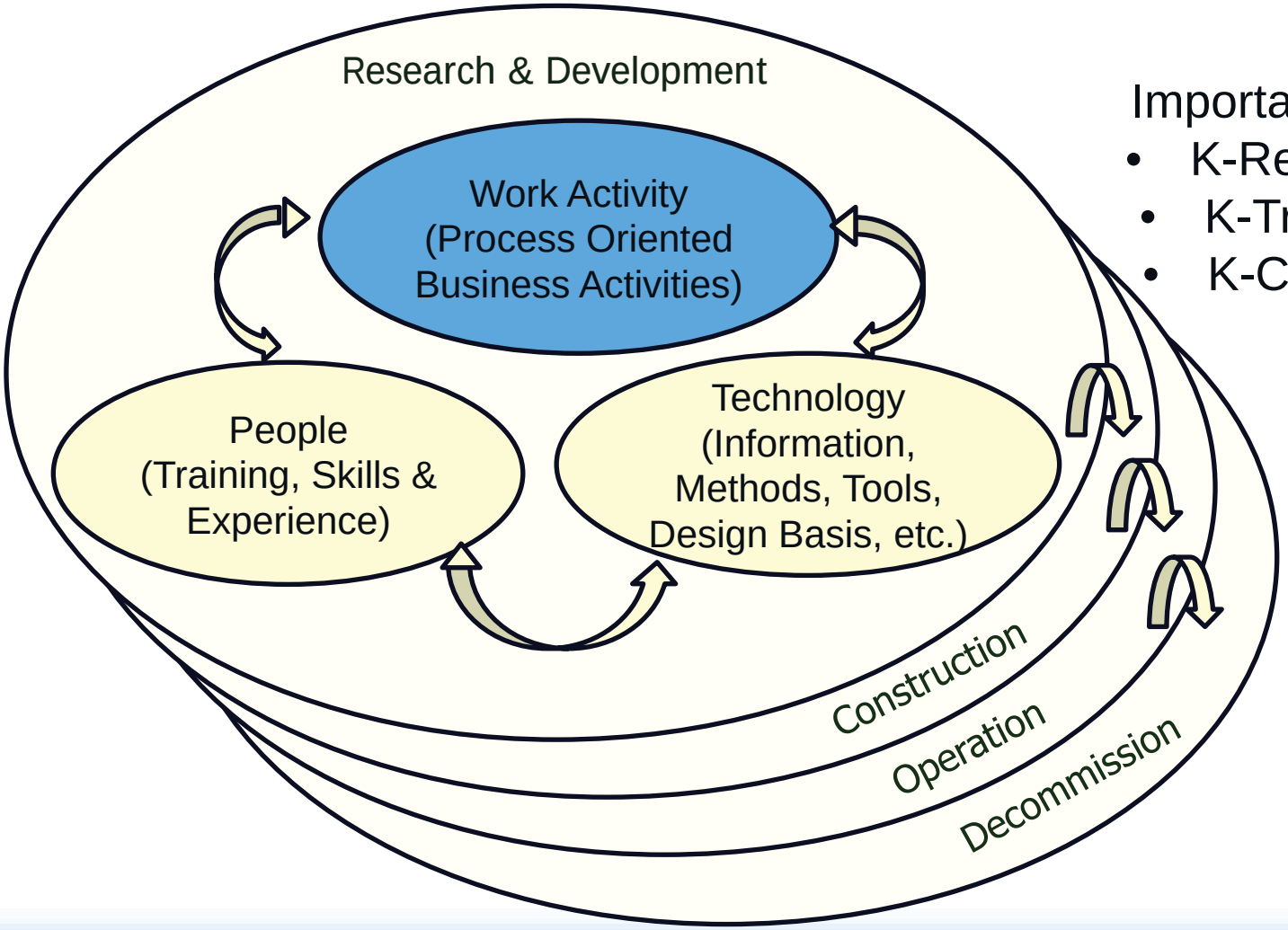
An example: Ancient Roman ruins under Vienna had integrated aqueducts and sewage systems!

History shows us knowledge can be lost! (2)

Another example: Construction methods of older churches in Europe have been lost!

Risk of Knowledge Loss in Nuclear Organizations is Real

Maintaining nuclear knowledge and competence over the life-cycle

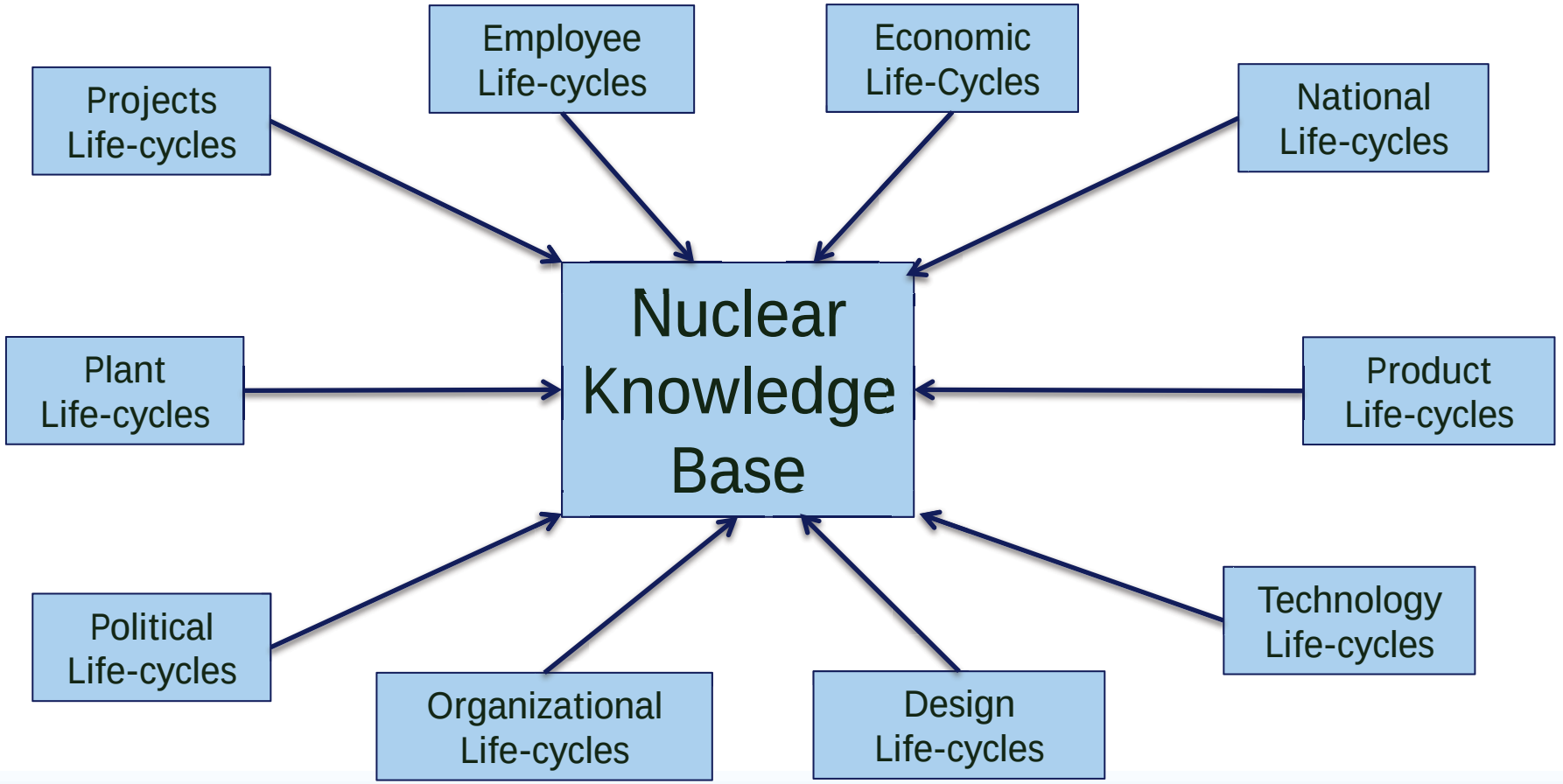


Importance of:

- K-Retention
- K-Transfer
- K-Capture

Life-Cycle Phases…

Threats to the Nuclear Knowledge Base (occur on many life-cycle dimensions)



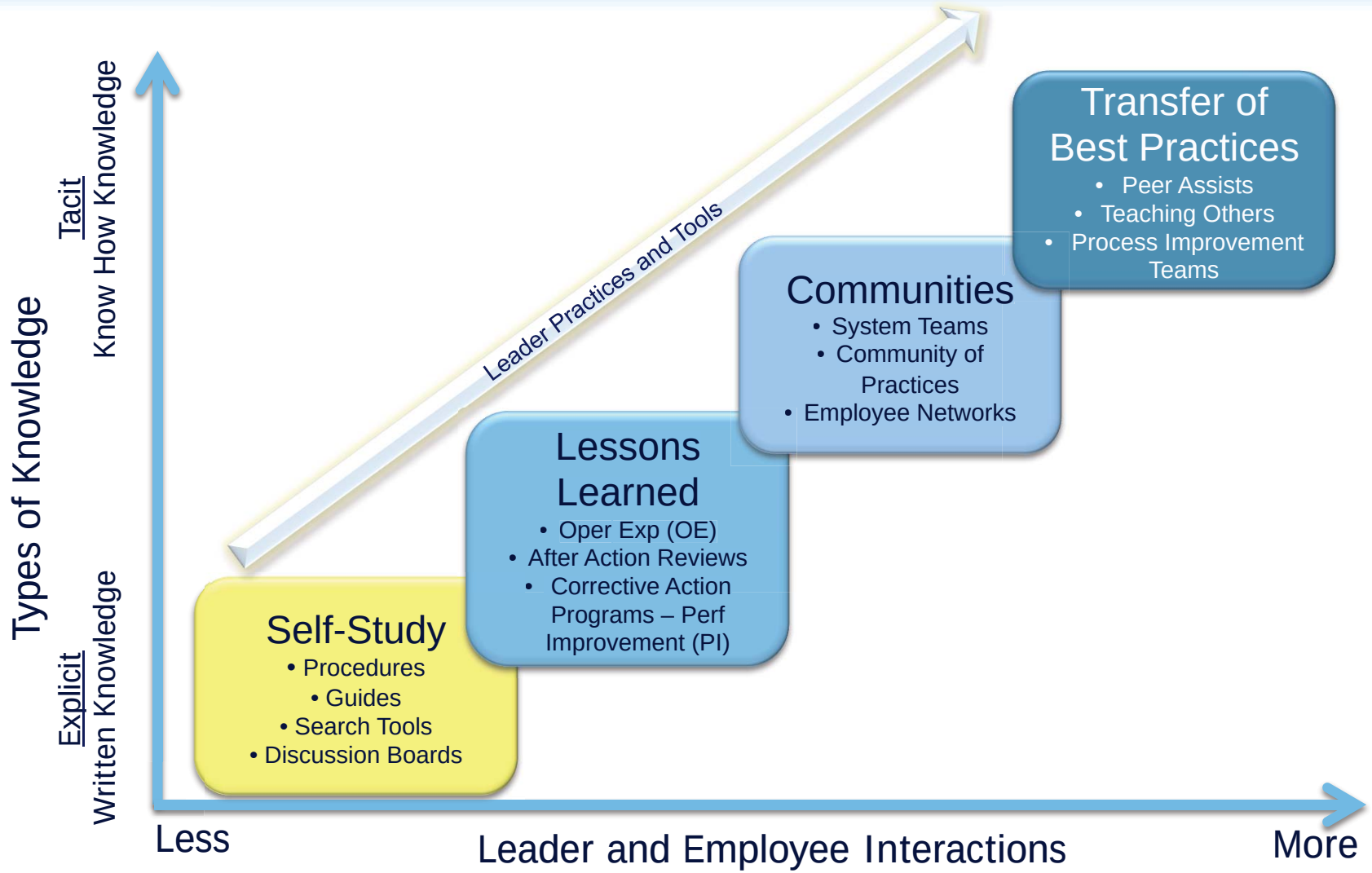
Barriers to Resolution

- Financial
- Ownership (perceived responsibility)
- Intellectual property
- Resource limitations
- Awareness (importance)
- Support (perceived priority)
- Time available (and urgency)
- Manageability

Competency Building Timelines (1)

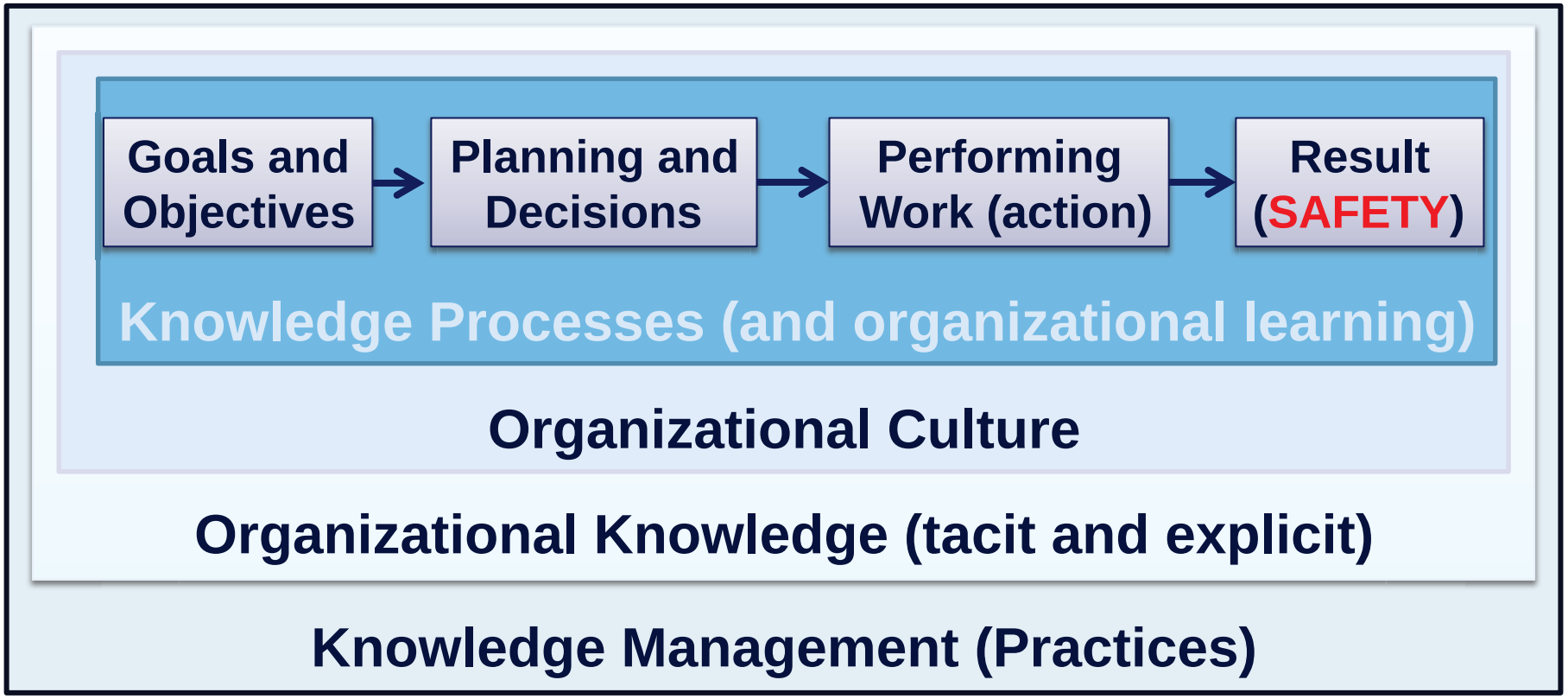
Adapted from David Heler – Palo Verde Human Resources

Competency Building Timelines (2)

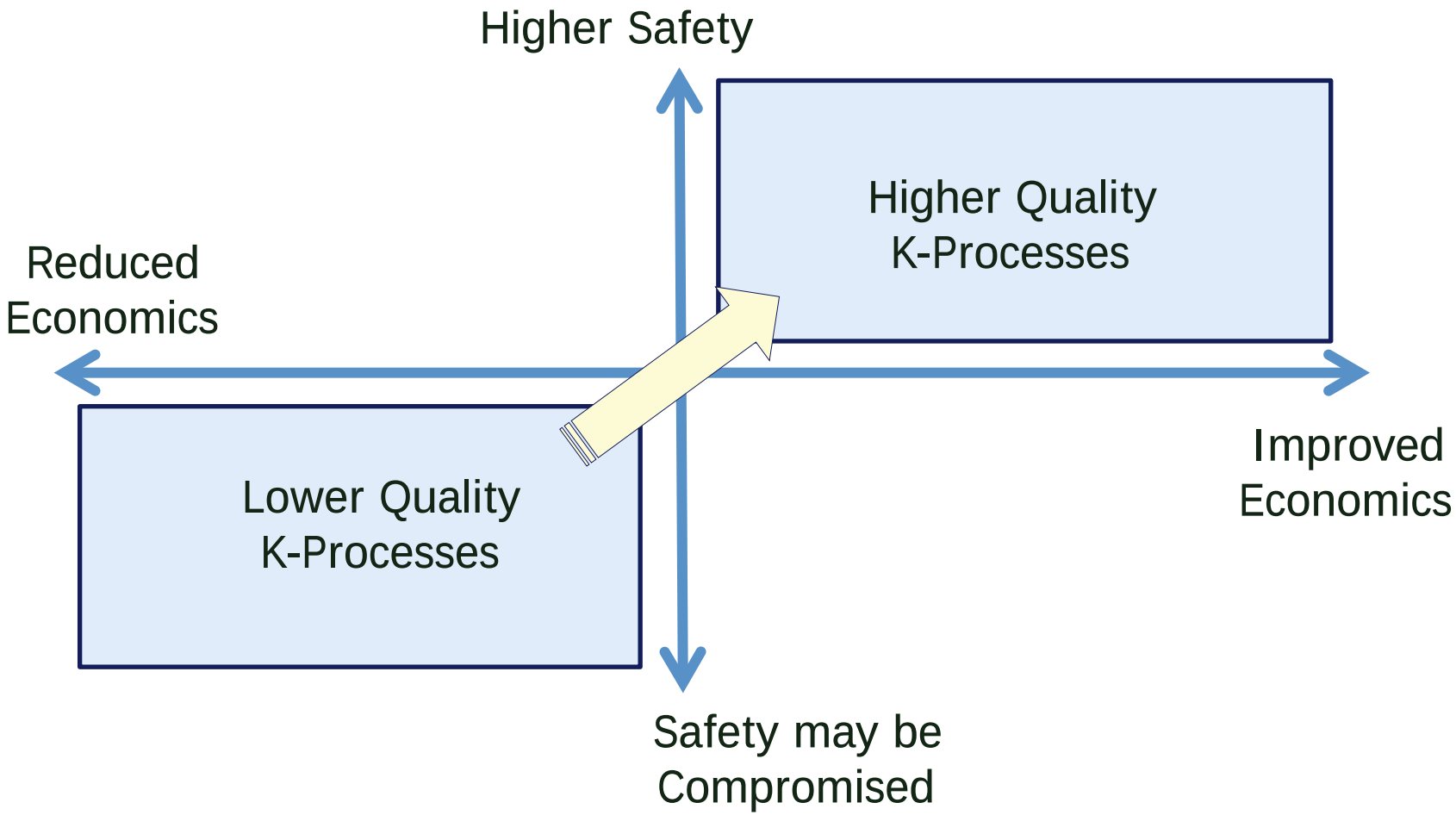


Adapted from David Heler – Palo Verde Human Resources

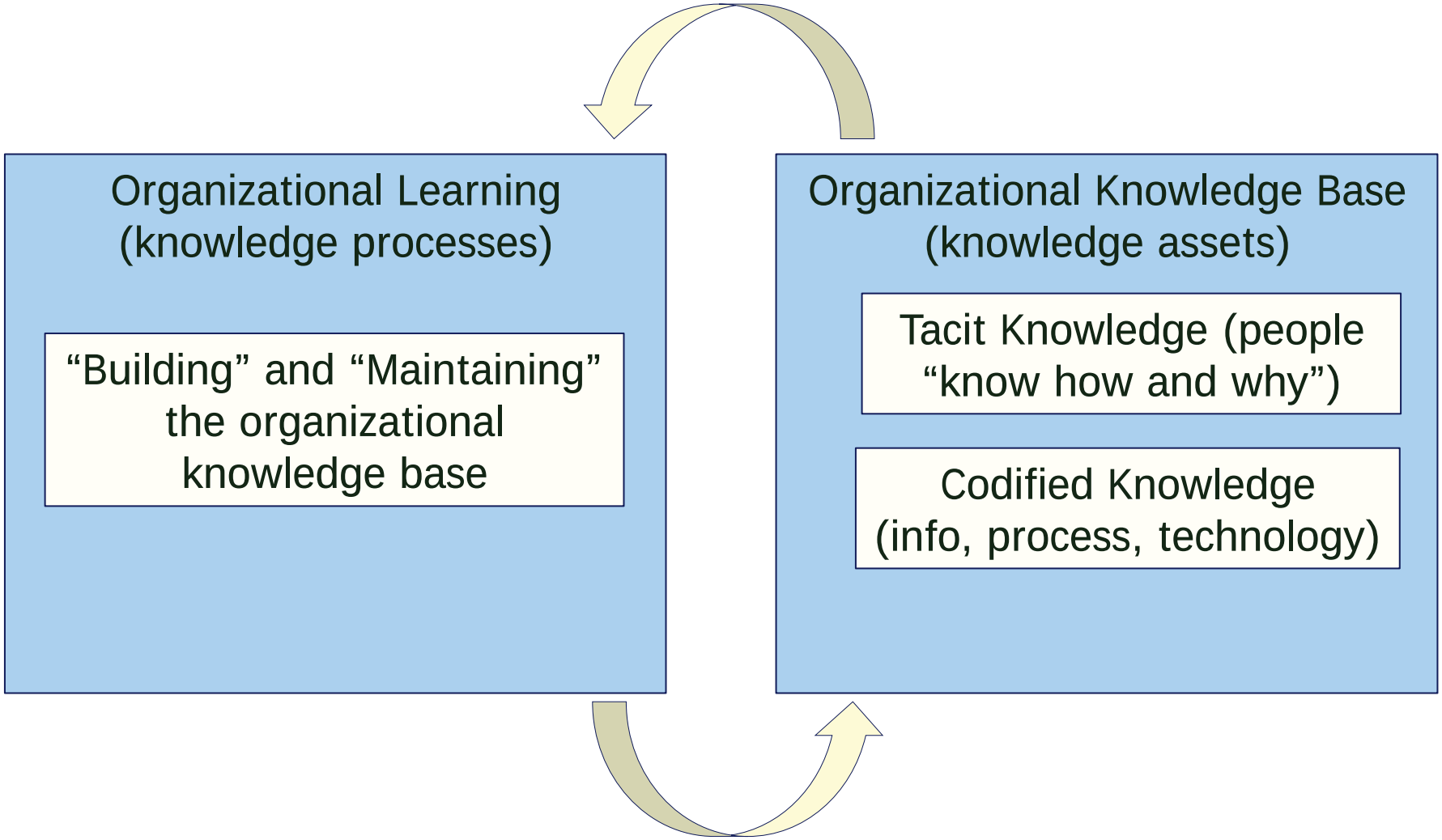
Linking KM to Safety in Nuclear Organizations



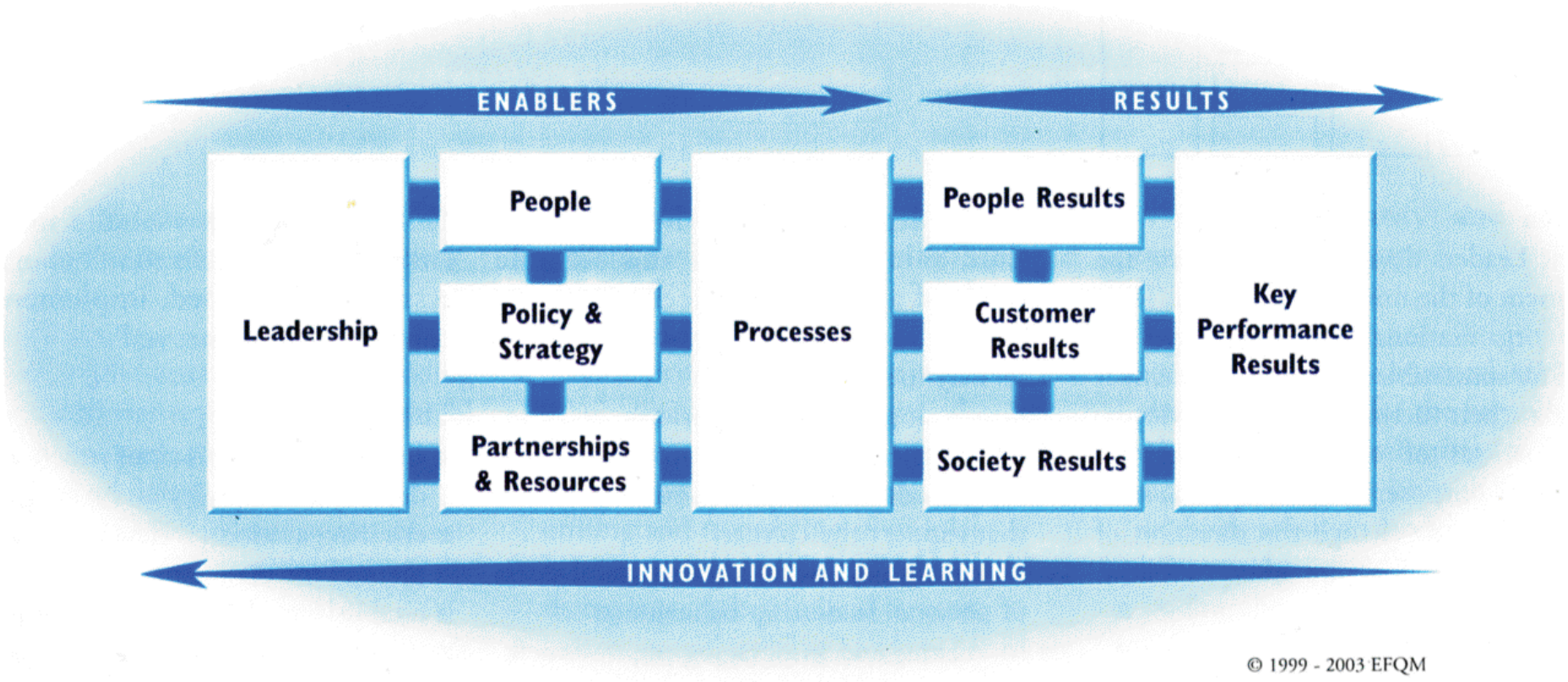
Expected Impact of KM on Nuclear Facilities



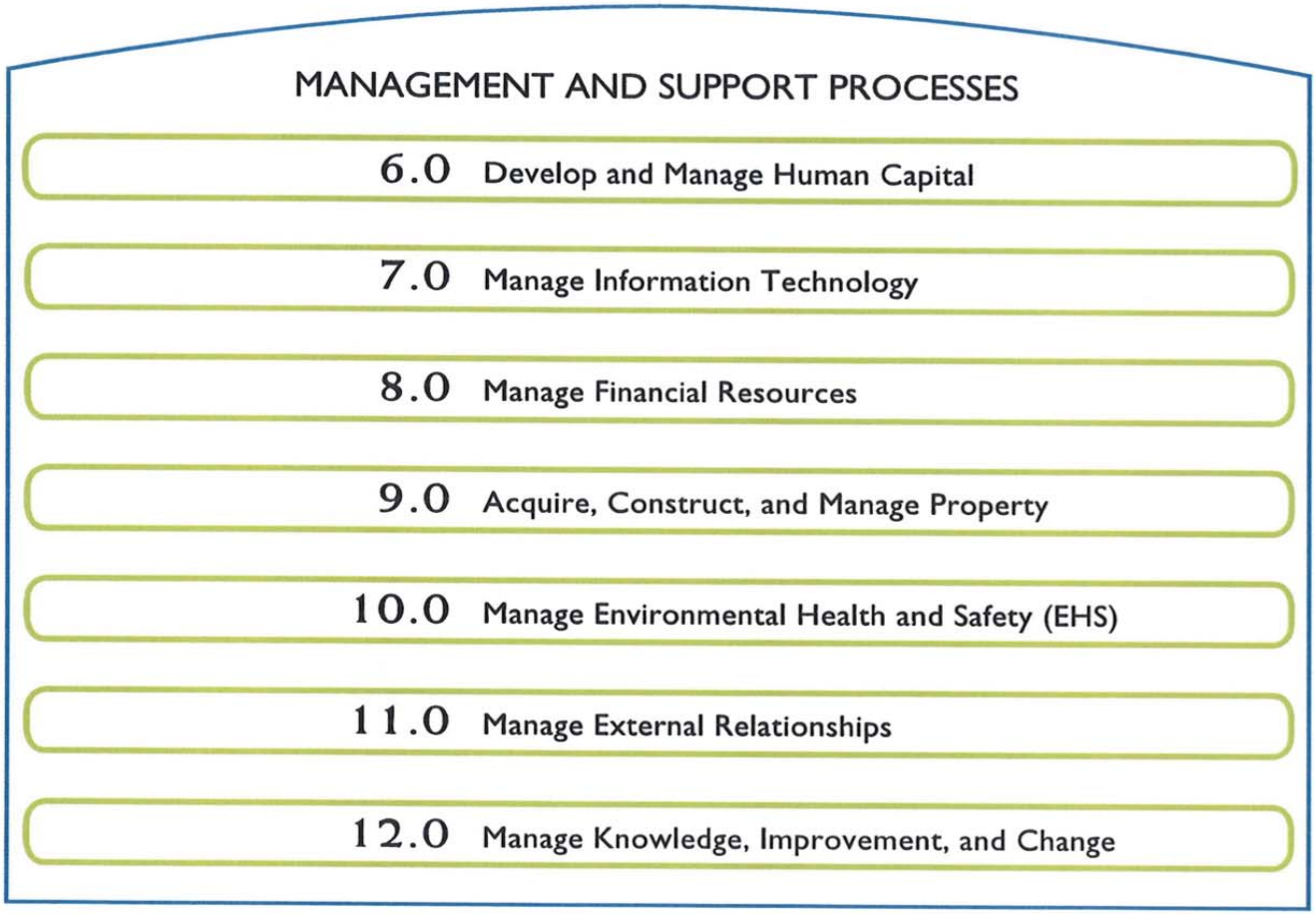
Basic Elements of a KMS



Quality Management Systems Perspective on Organizational Performance

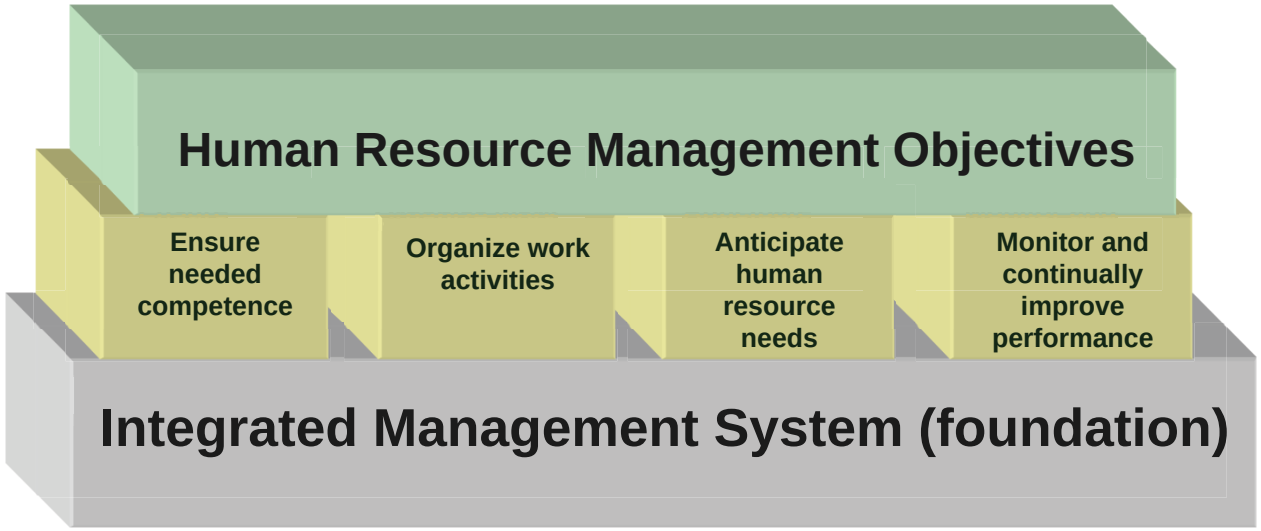


Quality Management Systems Perspective on Management and Support Functions

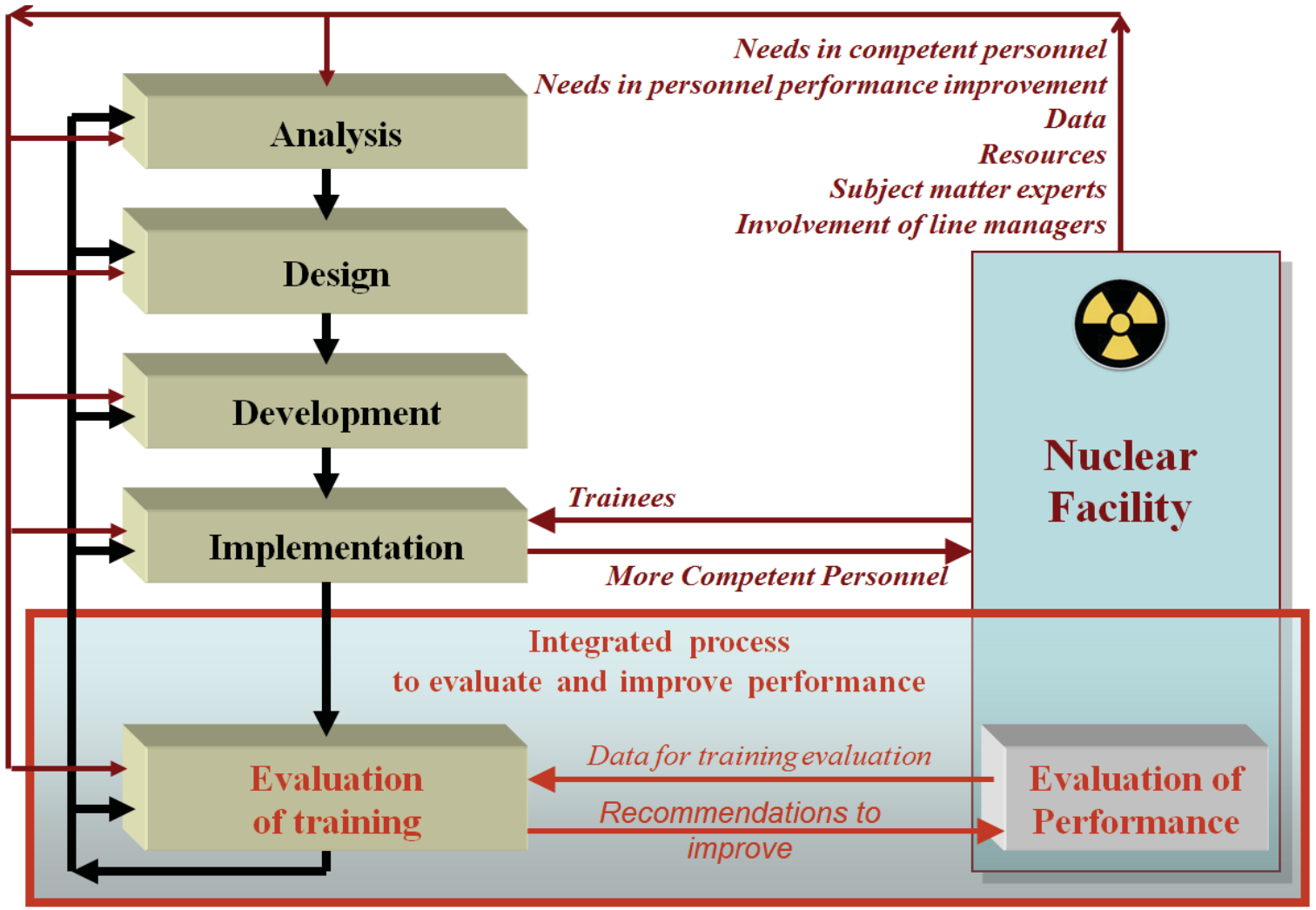


Adapted from APQC Standard Processes Diagram

Traditional View of HRM



Example of Knowledge-driven Management System: SAT-based Training Program



NPP Management Systems

- Design basis configuration management
  - Design change control & approval
- Equipment qualification program (environmental qualification, condition assessment)
- Equipment reliability program
- Life-cycle nuclear asset management program
- Licensing compliance
- Operations
- Training program
- Human resource management program
- Nuclear Quality Assurance program
- Worker protection (occupational health and safety programs)
- Supply chain management program
- Operating experience feedback system
- Waste Fuel management
- Performance management program
- External liaison and stakeholder communications
- Corrective action processes
- Plant maintenance (condition based maintenance, reliability centred maintenance. Preventive maintenance)
- Outage planning
- Work management systems
- IT/IS support processes
- Planning processes
- In-service testing program
- Information and records management
- Reactivity management
- Radiation protection program
- Site security
- Emergency response program
- Etc.

What drives organizational competency requirements?

Other Considerations

- View of organizational competency requirements as a "*demand/supply flow model*" perspective
- View as balance of capability "*specialization verses generalization*"
- View organizational capabilities in terms of "*depth of capability verses allocation verses demand*"
- View of what future organizational capability map looks like and how to get there?

Other considerations (cont'd)

- Stability of external drivers (strategic goals, external demand, uncertainty, etc.)
- Stability of internal drivers (type of organization)
- External constraints (obligations)
- External risks (uncertainty, failure)
- External opportunities (positioning)
- Knowledge loss risk perspective
- Knowledge building barriers perspective

Mission
Vision and
Strategy

What defines success for our organization?

What do we need to be good at?

Business functions
Major processes
Core competencies

What happens?
What needs to happen?
What resources needed?

- *Human*
- *Technology*
- *Other?*

Activities

Activities

Activities

Activities

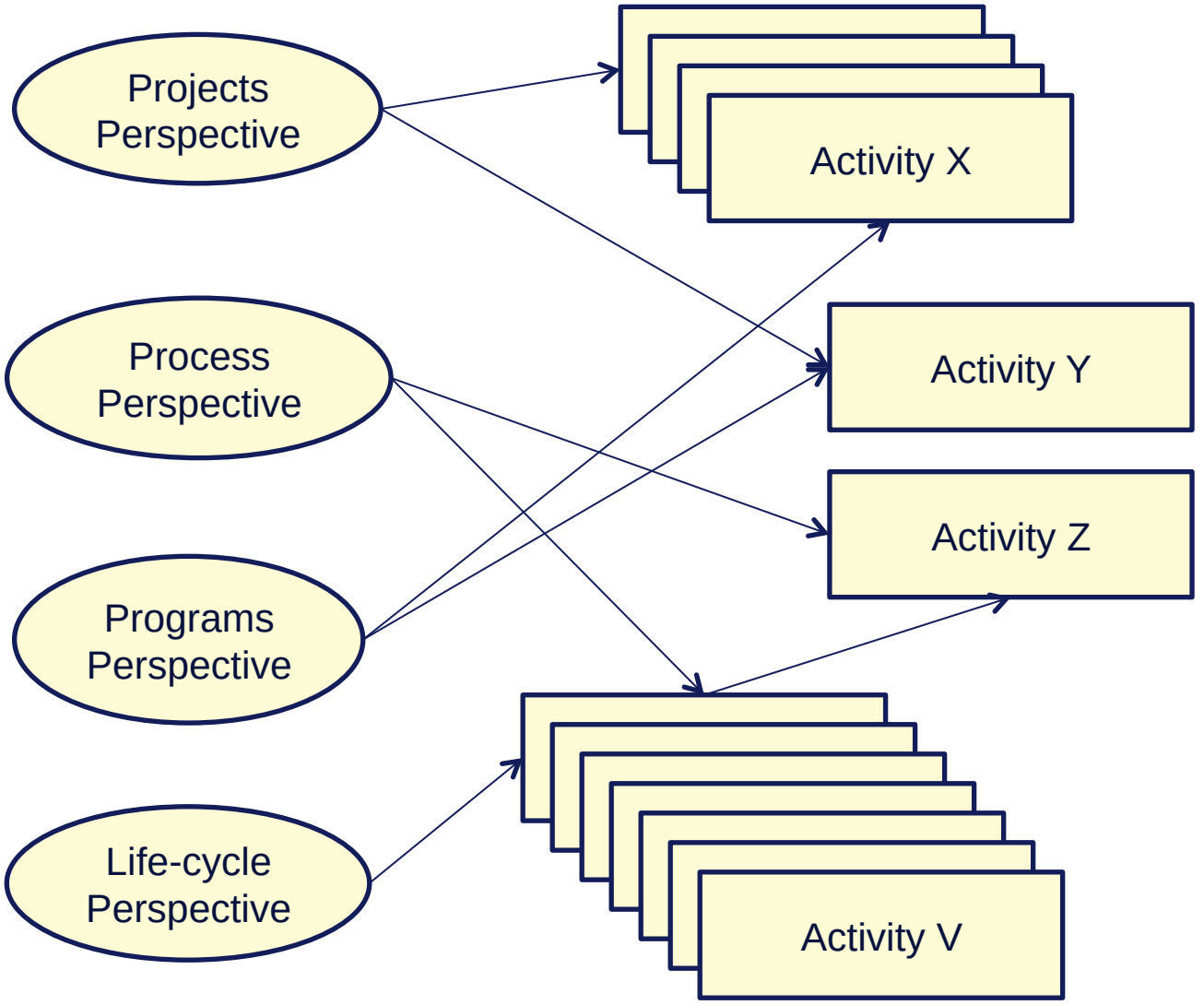
Activities

Activities

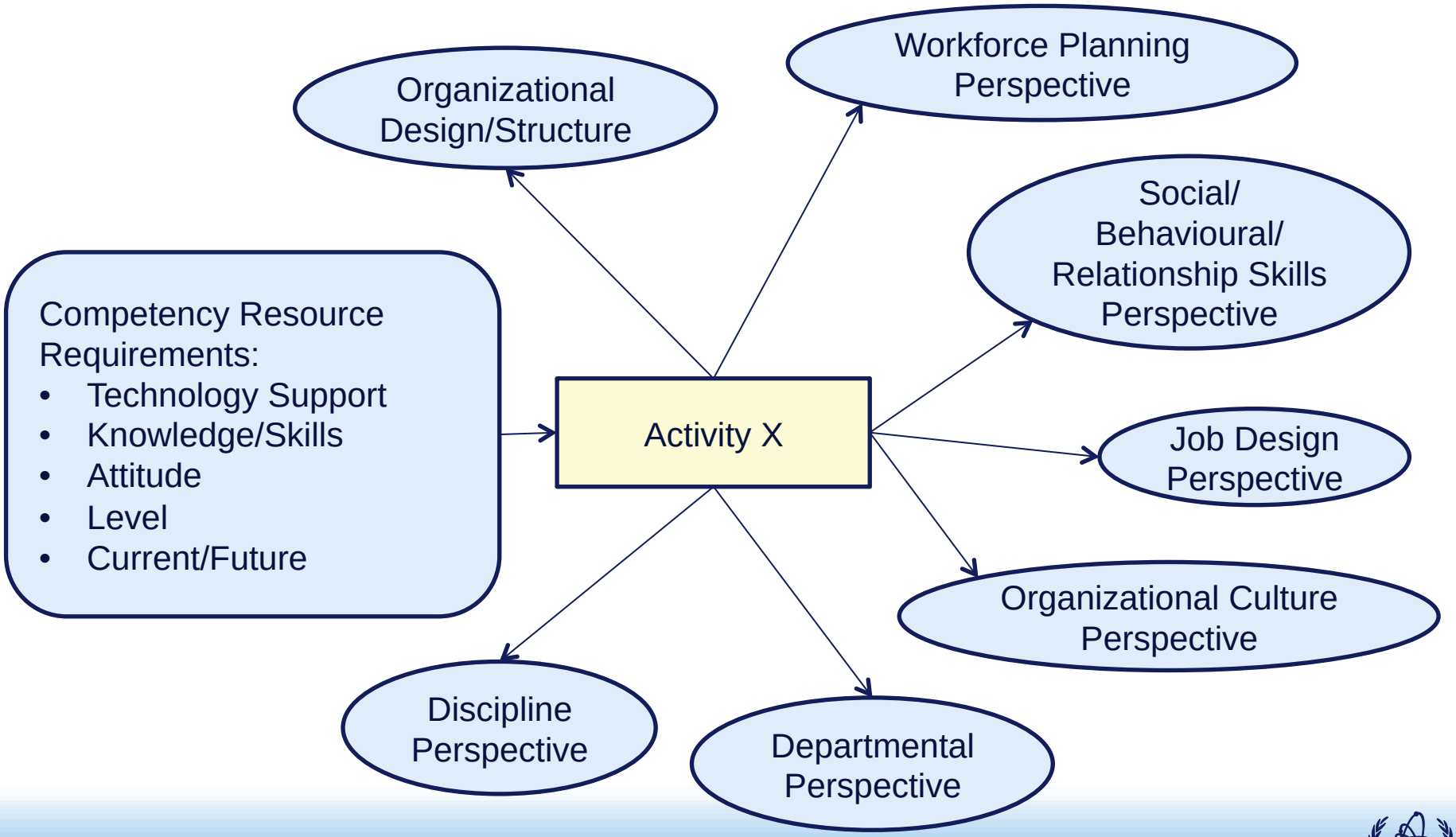
Activities

- *Evaluate current*
- *Define future*
- *Identify gaps*

Drivers of demand for work (examples)

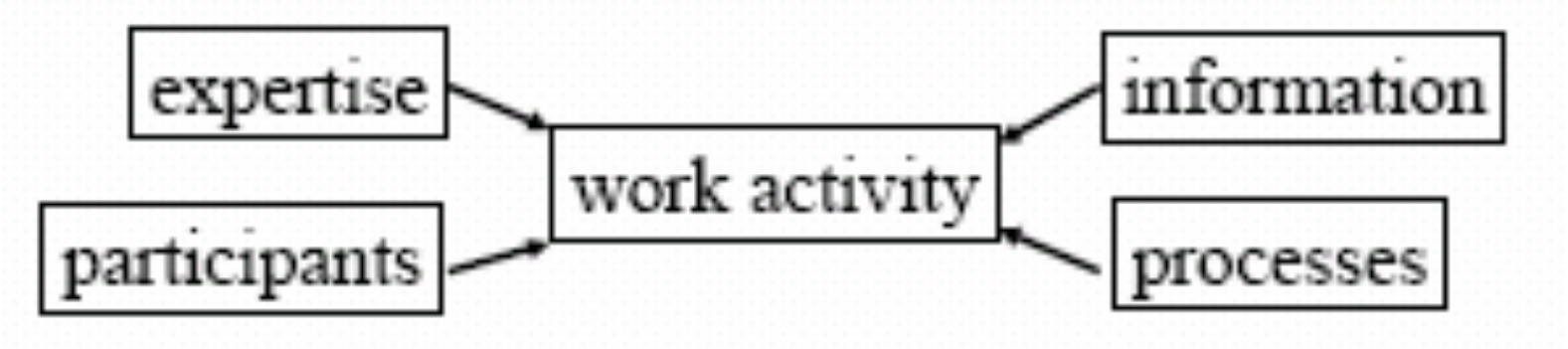


Competency Requirements a Function of Work Activity



KM Thinking Applied to Work Activity

- What are the critical K-processes?
- What are the characteristics of the relevant knowledge needed?
- Who has or should have this knowledge?
- What mechanisms are needed for the generation and utilization of this knowledge?
- What organizational conditions, processes, and changes are needed to make it work?



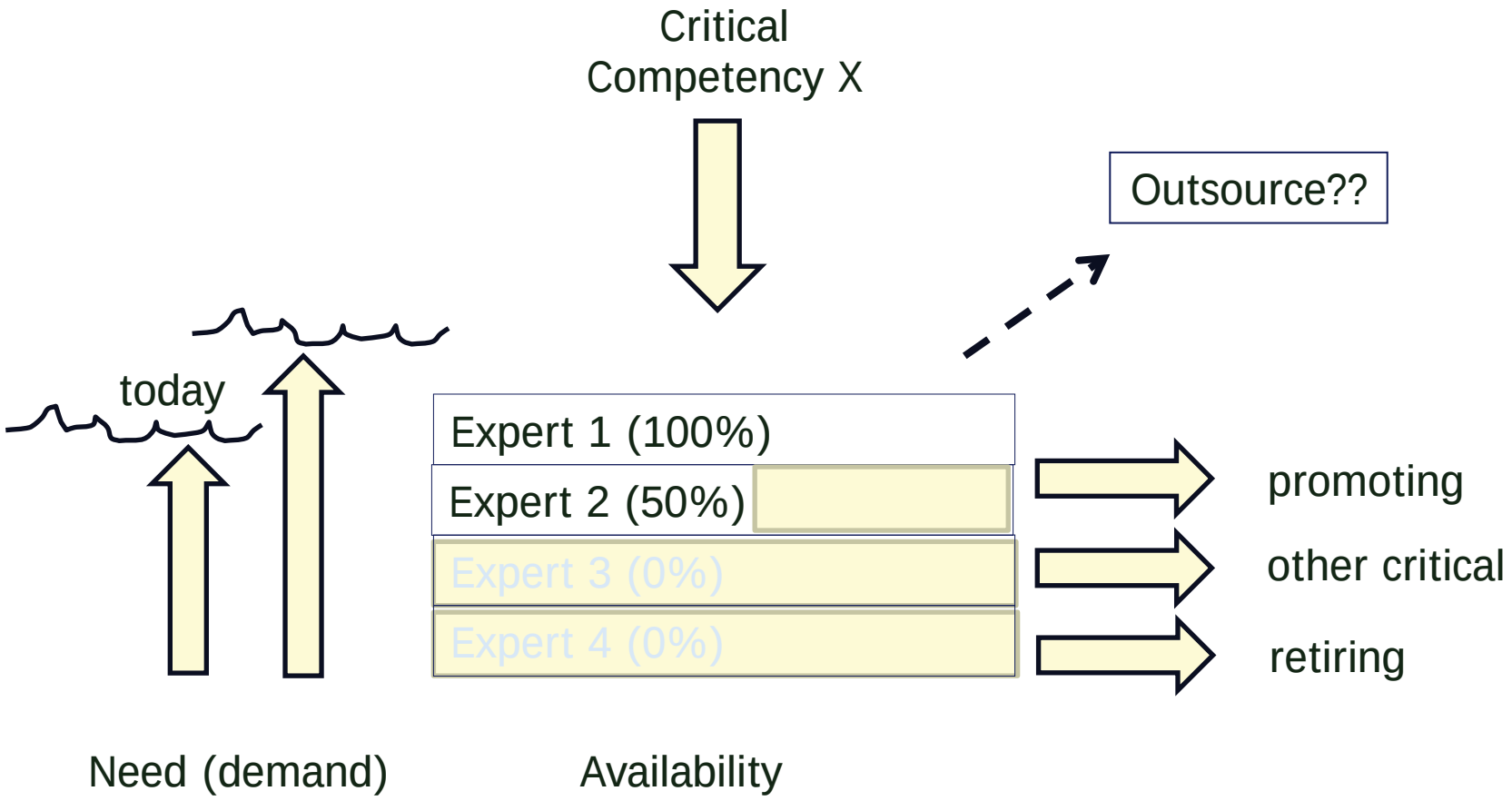
Workflow Analysis Considerations (examples)

- Processes defined and understood
- Decision processes
- Complexity
- Competencies required
- Stakeholders (owner, producer, consumer, maintainer)
- Verification processes
- Records
- Knowledge capture and retention
- Knowledge transformation
- Knowledge utilization
- Knowledge transfer & sharing
- Knowledge acquisition & adoption
- Approval processes
- Validation processes
- Feedback and learning processes
- Knowledge integration
- Technology support for work process
- Data/information inputs
- Data/information outputs
- Embedded methodology
- Decision/work sequences
- Safety issues
- Economic issues
- Risk issues
- Responsibility
- Review and feedback
- Corrective actions
- Security
- Training
- Data integration
- Knowledge resources

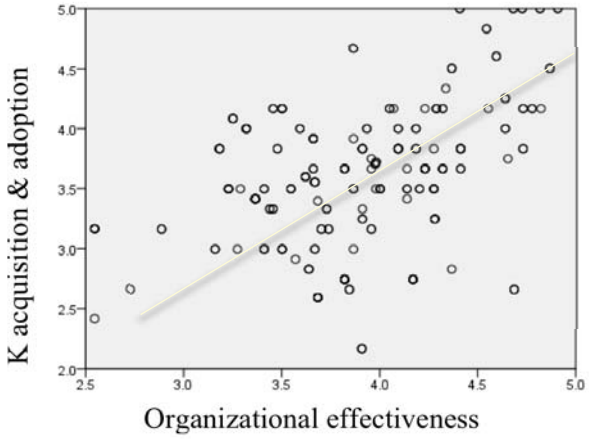
Information and Data Management Considerations (examples)

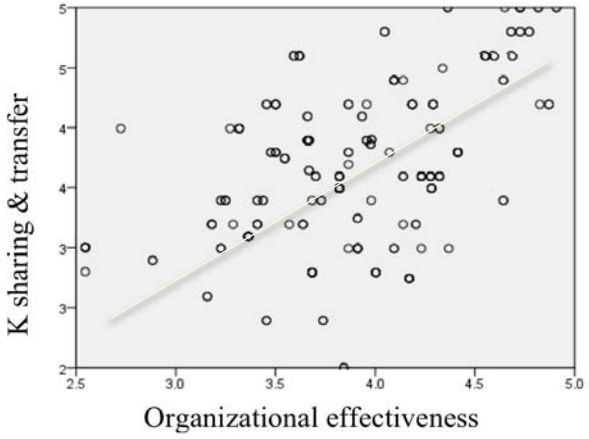
- Sensitivity
- Validation
- Production
- Ownership
- Maintenance
- Access
- Security
- Permanence
- Users
- Distribution
- Archival
- Storage and retrieval
- Organization
- Structure
- Interchange
- Completeness
- Consistency
- Correctness
- Clarity
- Language
- Terminology
- Classification
- Taxonomy
- Formats
- Conversion
- Level of detail
- Time sensitivity
- Safety-related
- Importance (criticality, cost to replace)

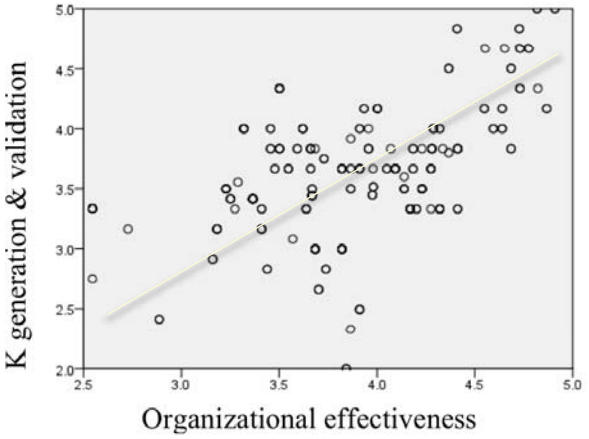
Organization-wide Competency Demand

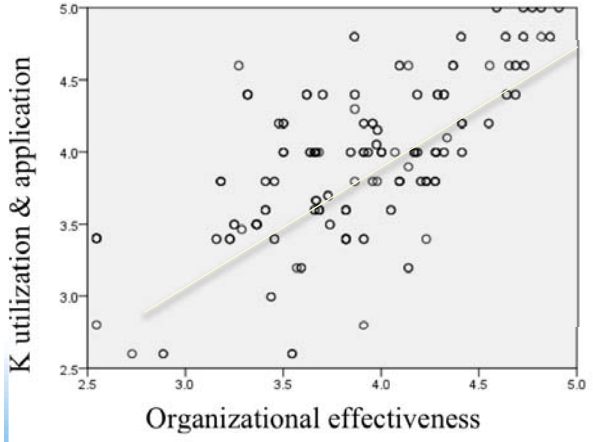


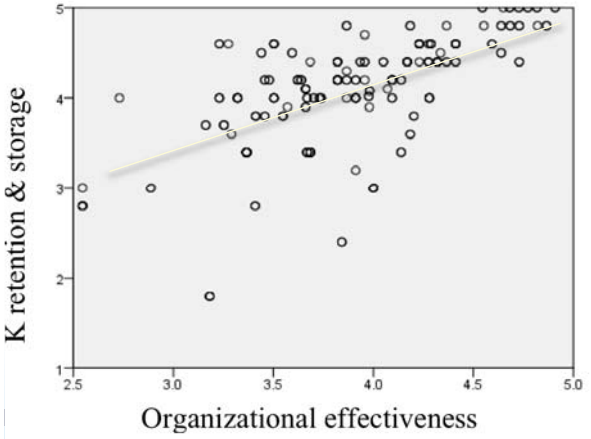
Links between Knowledge Processes and Organizational Effectiveness





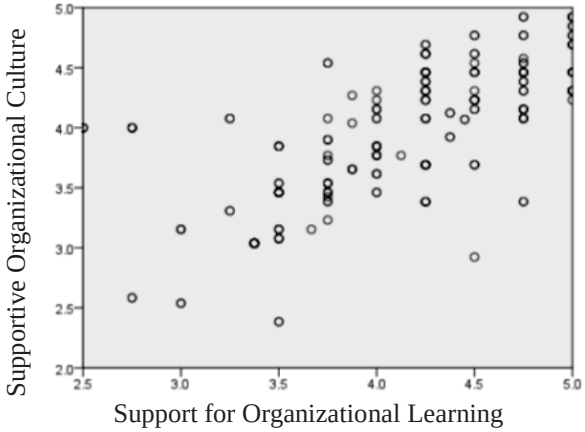


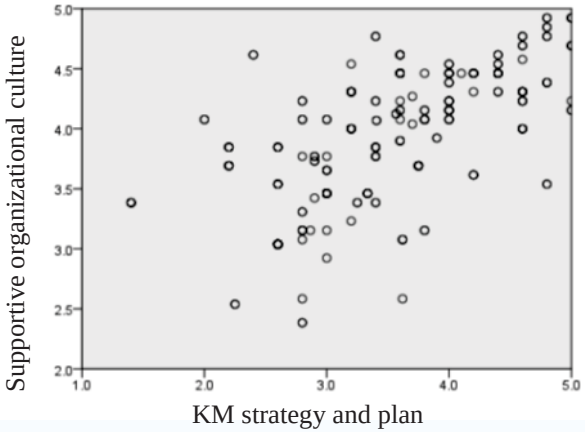




Links between Knowledge Management Practices and Supportive Organizational Culture

Figure 1. Scatterplot of SOC vs. SOL





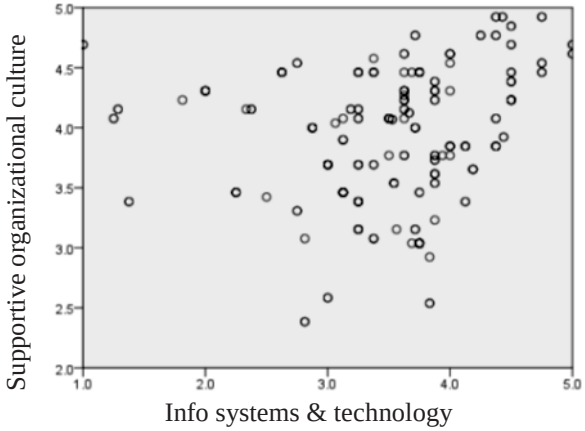
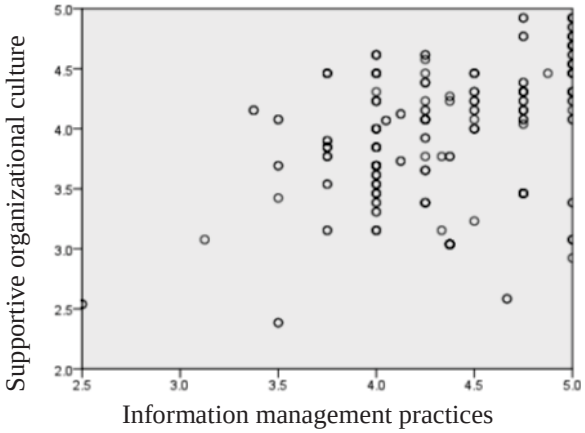
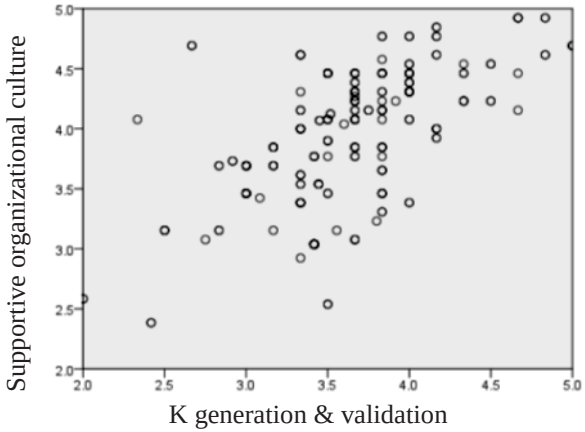


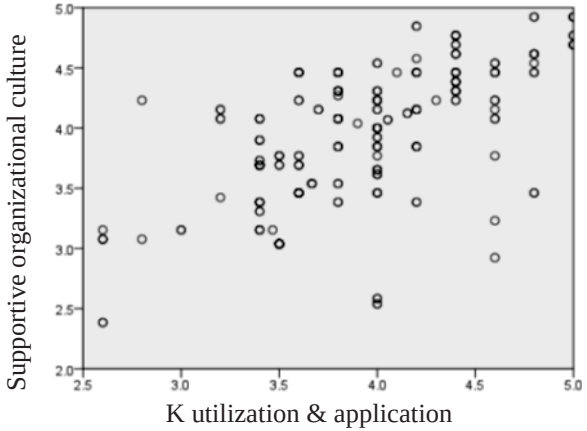
Figure 1. Scatterplot of SOC vs. HRP

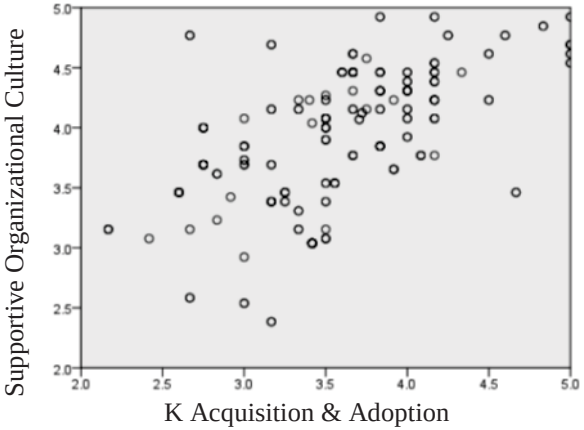


Links between Supportive Organizational Culture and Knowledge Processes

Figure 1. Scatterplot of SOC vs. KA







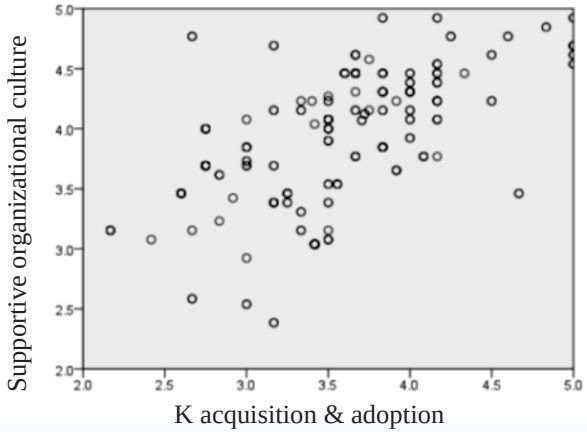
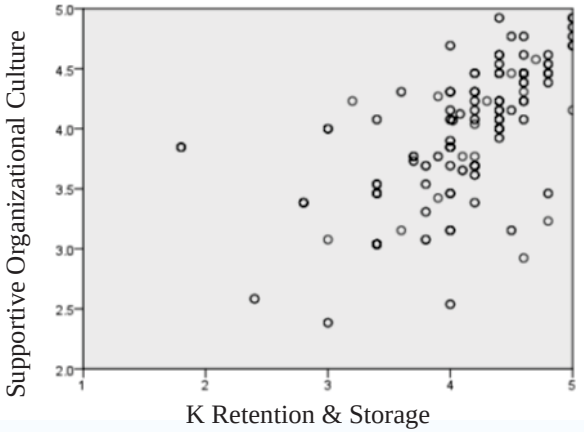
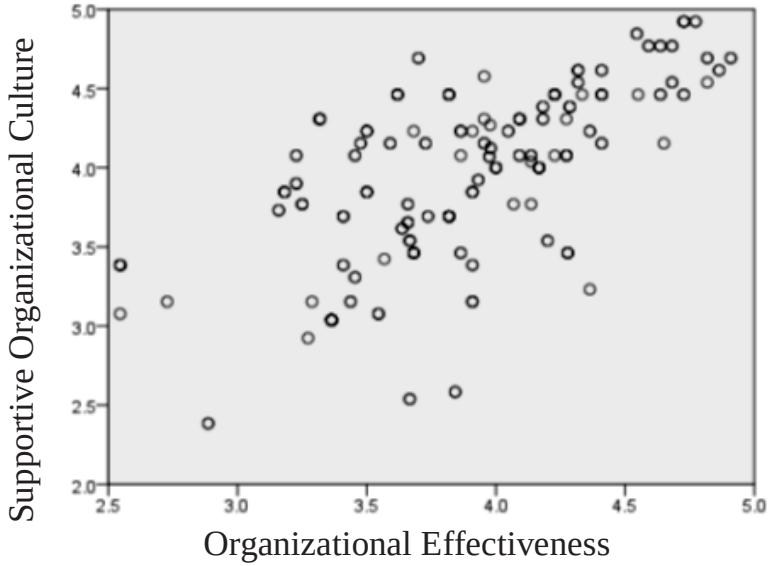


Figure 1. Scatterplot of SOC vs. KR

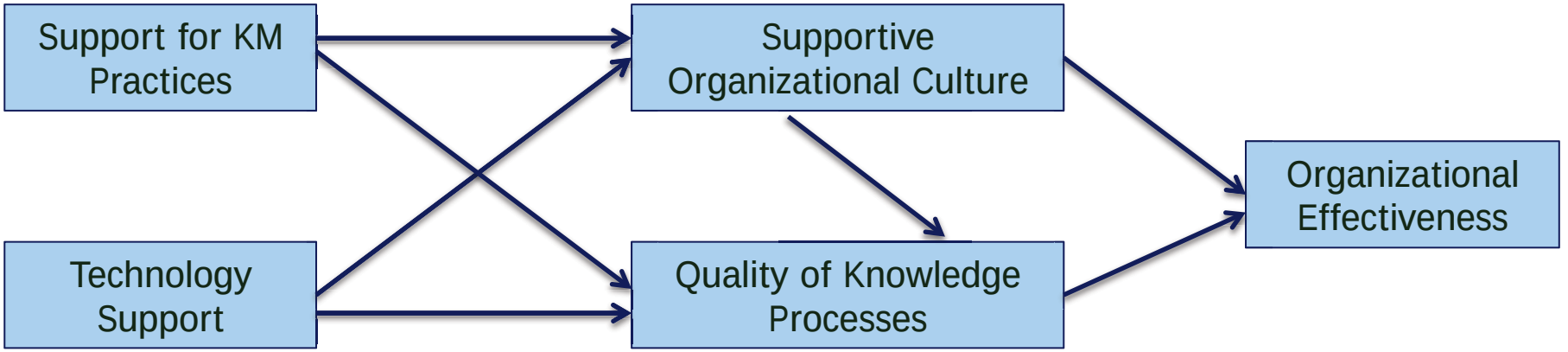


Link between Supportive Organizational Culture and Organizational Effectiveness

Figure 1. Scatterplot of SOC and OE

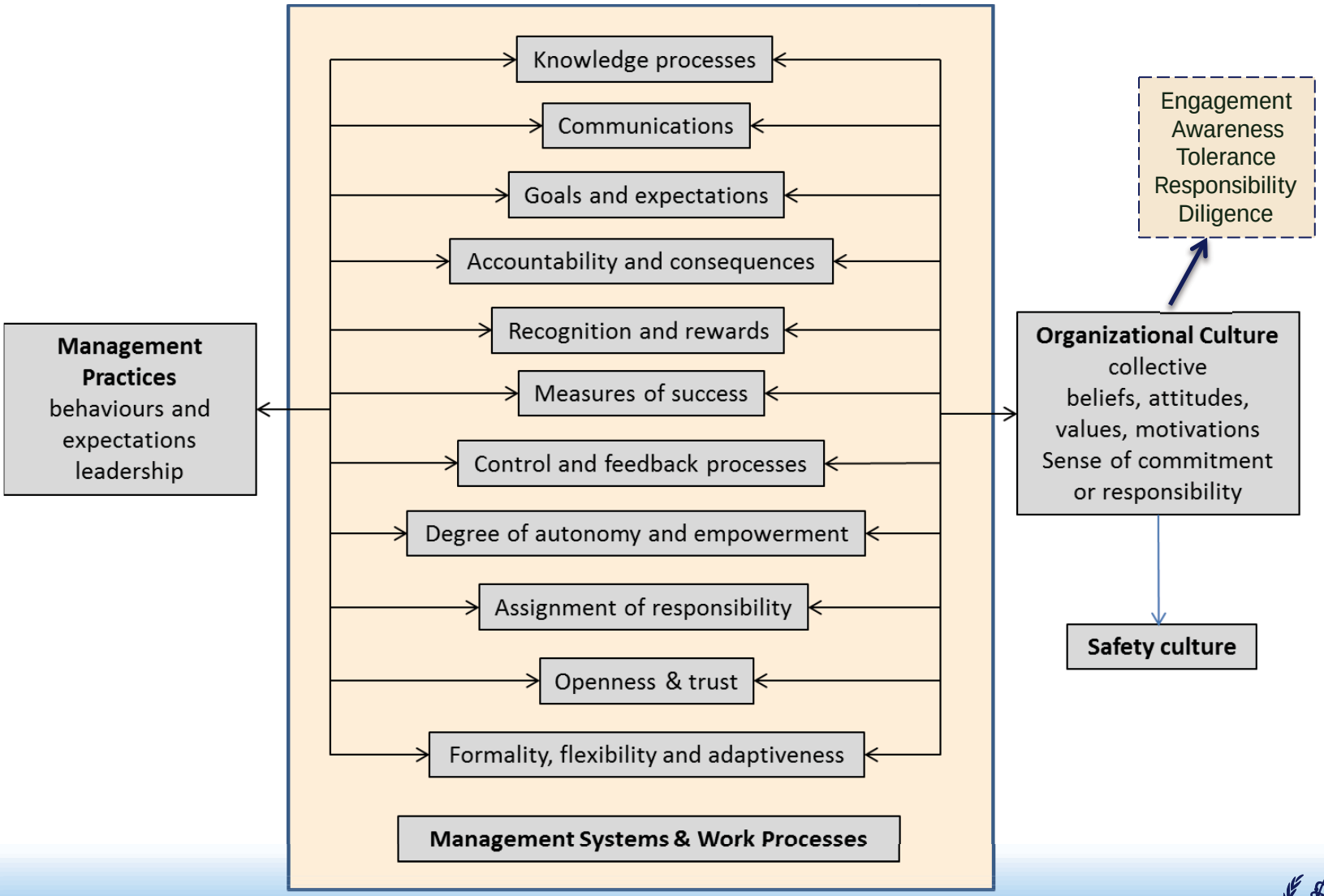


KM Performance Model

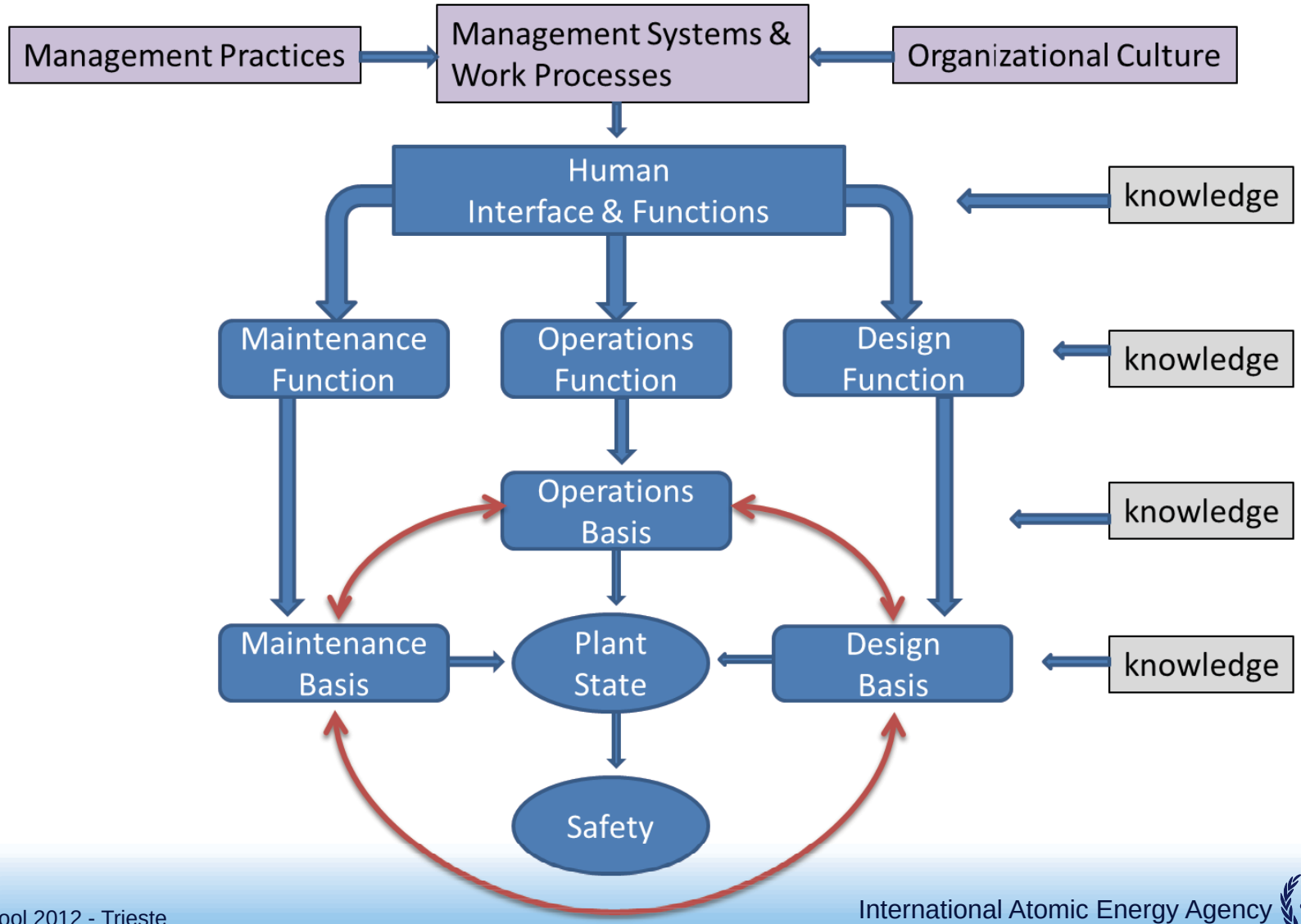


(Ref: de Grosbois, 2011)

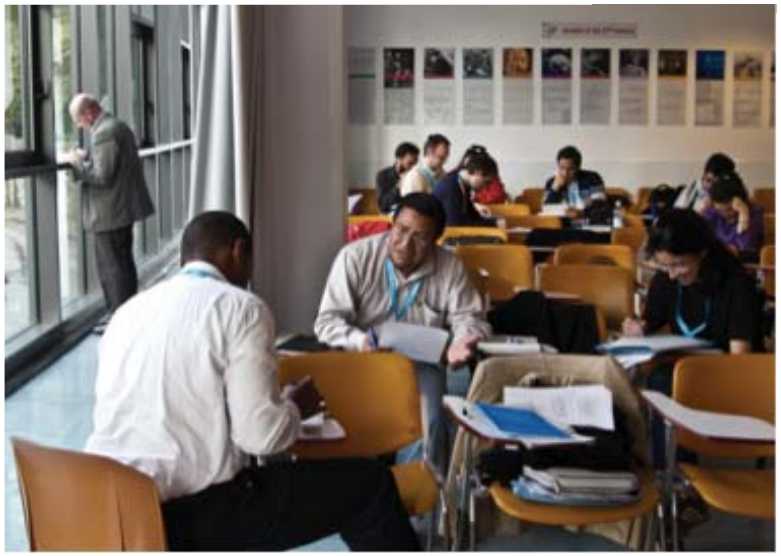
The Links between Management Practices and Organizational Culture



Understanding how knowledge impacts safety



NKM accomplishments of the past decade…

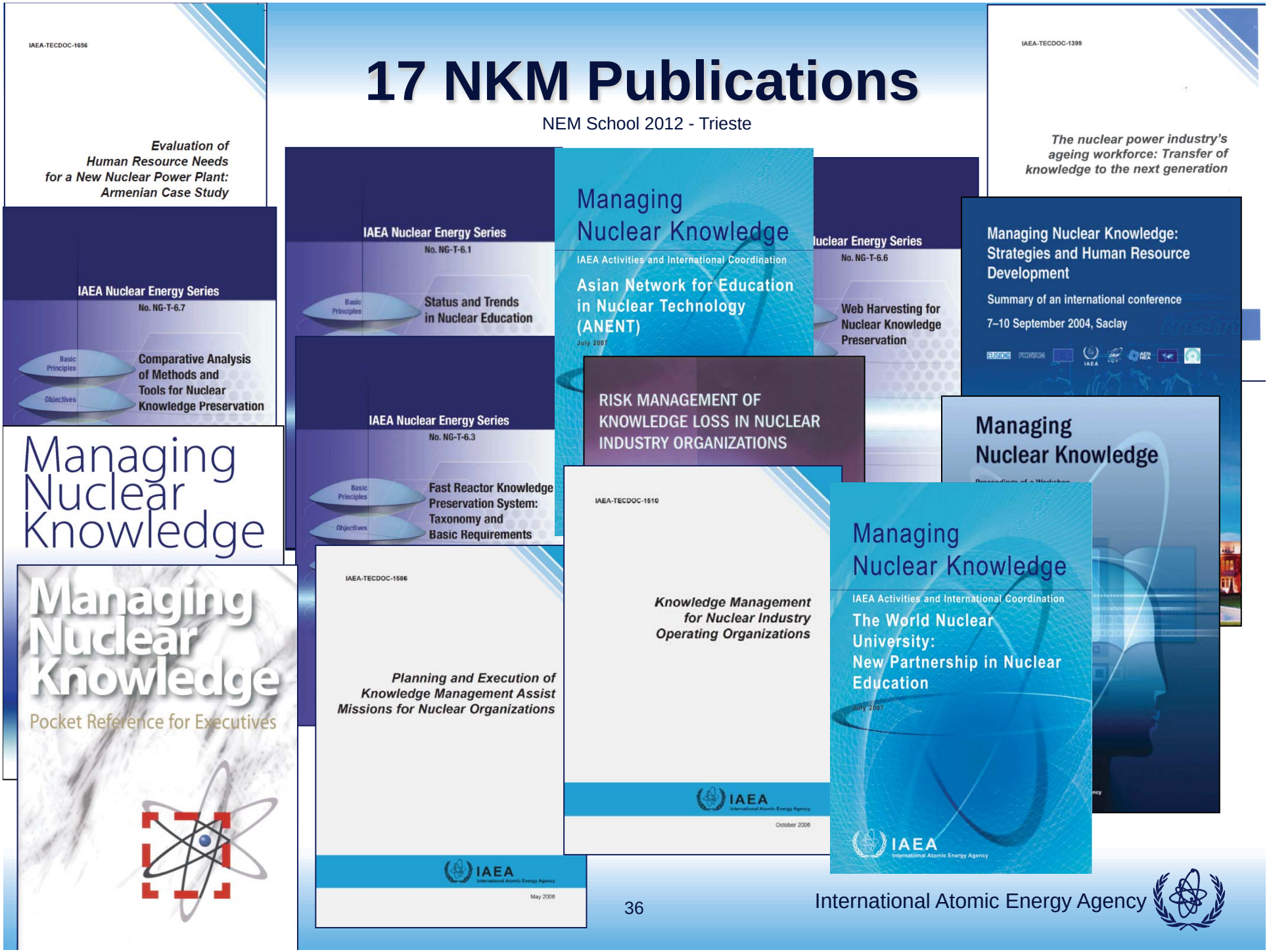


Establishment of the NKM Subprogram for Member States

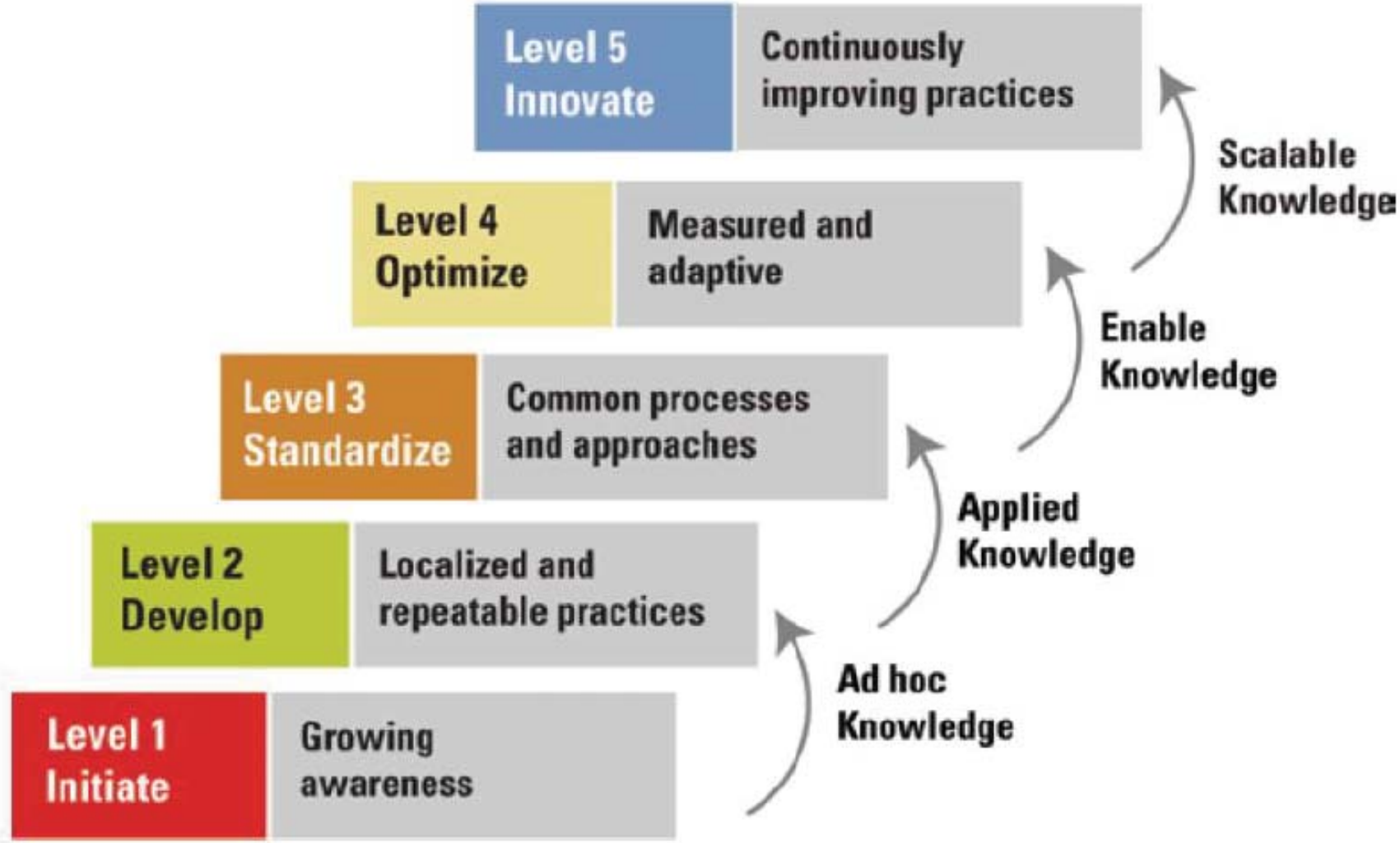
Establishment of the NKM Section

17 NKM Publications

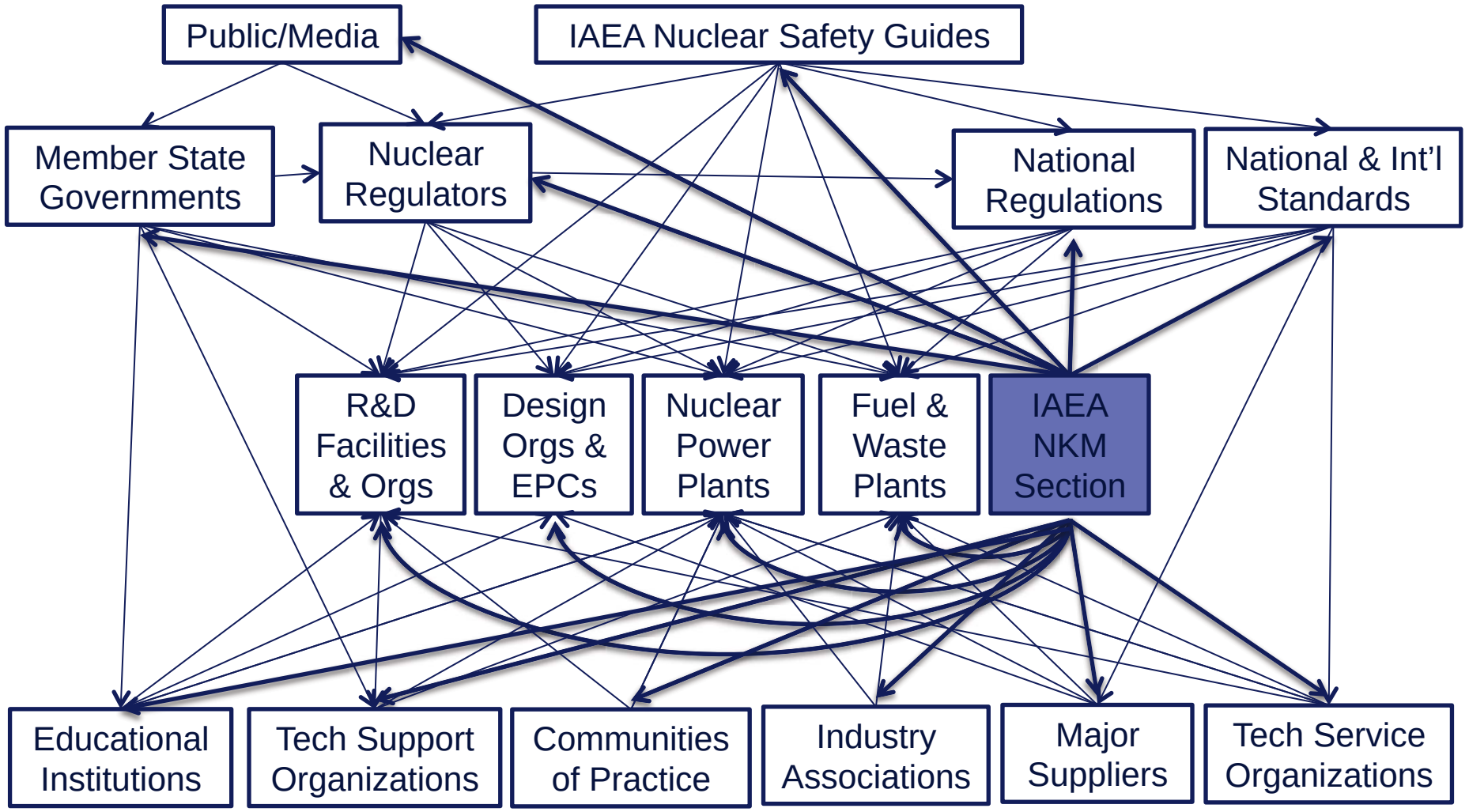
NEM School 2012 - Trieste



APQC'S STAGES OF KNOWLEDGE MANAGEMENT MATURITY



Industry Wide Perspective for NKM



NKM Strategic Path Forward…

- Build on success of current program
- Maintain and build current initiatives
- Expand to meet new needs & opportunities
- Adapt to evolving needs of member states
  - Existing nuclear energy program needs vary
  - Developing nuclear energy program needs vary

Thank you!
Questions or comments?

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